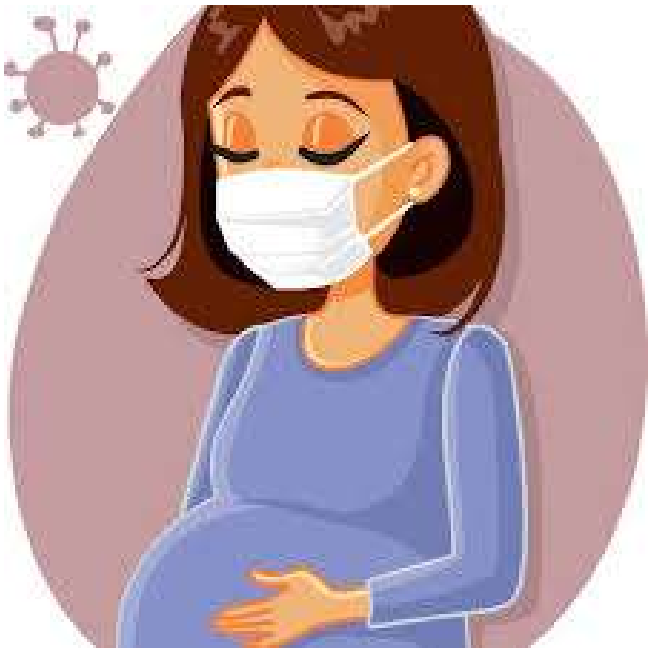
SLCOG Guideline on Management of Covid-19 in Pregnancy



Sri Lanka College of Obstetricians and Gynaecologists

Prepared for Sri Lanka College of Obstetricians and Gynaecologists

by

Dr Mayuramana Dewolage (MBBS, MD, MRCOG)

Consultant Obstetrician and Gynaecologist

Colombo East Base Hospital, Mulleriyawa

Dr Achintha Dissanayake (MBBS, MD, MRCOG)

Consultant Obstetrician and Gynaecologist

Colombo East Base Hospital, Mulleriyawa

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Severe Acute Respiratory Syndrome Corona virus -type 2(SARS-Cov-2) is the strain of corona virus causing Covid-19, which was first detected in Wuhan (Hubei province), China in 2019. On 11th of March 2020 World Health Organization declared Covid-19 a global pandemic and up to date there have been over 159 million cases with over 3.3 million deaths worldwide(1). In Sri Lanka, up to date there have been over 1000 pregnant women treated for Covid -19 with 3 reported maternal deaths as a result of Covid-19.

This mRNA virus has four main structural proteins named Spike (S) protein, membrane (M) protein, envelope (E) protein and nucleocapsid (N) protein. S protein is mainly responsible for host cell attachment and penetration mediated through ACE2 receptors. During the asymptomatic phase virus enters the nasal epithelial cells and undergo replication and propagation along the conducting airways. During this period, individuals will be infectious and continue to transmit the virus. In severe disease, virus enters type 2 alveolar pneumocytes causing pneumonia and respiratory distress(2).

The virus transmits mainly through respiratory droplets and aerosols from person to person. The virus has been isolated in biological samples such as urine and feces and transmission through fomites is possible (3). Vertical transmission of SARS-Cov-2, though reported is uncommon and its exact timing is unclear(4). Reported cases of neonatal infection are probably from horizontal transmission. Currently, there is no evidence of SARS-Cov-2 transmission through breast milk, although the virus has been isolated in breast milk in few studies(5). The incubation period of Covid-19 averages from 5-6 days, but can be as long as 14 days(6)(7).

Covid 19 can cause asymptomatic or symptomatic infection. Symptoms may vary from mild upper respiratory tract symptoms to severe pneumonia. Common symptoms and signs of covid-19 are as follows:

Symptoms

- Fever
- Sore throat
- Dry cough
- Malaise and body aches
- Headache
- Nausea and vomiting
- Diarrhoea
- Shortness of breath
- Chest pain
- Loss of taste and smell

Signs

- Maternal pyrexia
- Maternal tachycardia
- Hypotension (in severe cases)
- Tachypnoea
- SpO_2 <94%
- Fetal tachycardia
- Confusion (in hypoxia)
- Reduced urine output

Compared to pregnant women without Covid-19, symptomatic pregnant women with Covid-19 requiring hospitalization had worse maternal outcomes, including increased ICU admission

and death(8). Due to physiological changes in pregnancy, pregnant women are more susceptible to severe infection and respiratory compromise particularly in the latter half of pregnancy. In pregnancy chest wall compliance is reduced along with a reduction in functional residual capacity of the lung, particular towards the third trimester due to upward displacement of the diaphragm. Alveolar ventilation increases resulting in a compensatory alkalemia and shift of the oxygen dissociation curve to the right, to make more oxygen available to the fetus(9). These changes have implications in Covid-19 pneumonia and its management.

In Sri Lanka, during first wave and second wave majority of SARS-Cov-2 infections were asymptomatic. However, in the current third wave there has been a notable increase in symptomatic pregnant women along with an increase in severity of disease.

The aim of this document is to provide up to date guidance for clinicians offering care for pregnant women during the pandemic based on existing evidence, consensus opinion and local experience. Care may need to be individualized according to the patient requirement and recommendations may vary with emerging new evidence. The guideline consists of the following major topics.

1. Antenatal care during Covid -19 pandemic
2. Management of Covid -19 in pregnancy
3. Intrapartum care for a woman with Covid-19
4. Postpartum care for a woman with Covid-19
5. Management of a critically ill patient with Covid -19 in pregnancy
6. Vaccination in pregnancy

The following advice is a general summary for clinicians to assist in the care of pregnant patients infected, or at risk of infection, with COVID-19.

- Minimize your contact with potential COVID-19 patients and take measures to reduce the risk of viral spread within your clinic and hospital.

- Patients with a possible COVID-19 infection should be directed to a specialized testing clinic where this is available.

- Antenatal clinic/hospital should have a dedicated room in which to assess and test potential COVID-19 patients with appropriate personal protective equipment (PPE) provided.

- Patients entering your clinic/hospital should wear a face mask and at all times maintain a distance of 1- 2m from each other.

- Use telephone or video consultations wherever this is an appropriate alternative to a face to face consultation.

- Provide timed appointments, where possible, to avoid overcrowding within your clinic.
- Encourage patients to wait outside in designated outdoor seating areas with appropriate spacing until the doctor or nurse is ready to see them.
- Have a policy in your hospital to restrict visitors.
- All patients admitted to hospital should be screened for Covid -19. This includes an inquiry of symptoms, possible contact history. Based on the screening questions offer rapid antigen test (RAT) or RT-PCR for diagnosis of Covid -19. Until results are available treat as a possible Covid patient ensuring universal precautions and wearing appropriate PPE.

1. Antenatal Care during Covid-19 pandemic

- A reduced frequency of antenatal visits may be appropriate, especially in **low risk** antenatal mothers. When antenatal visits are conducted organize blood tests, ultrasound scans etc. at the same time to avoid repeated attendance to the hospital.
- Telephone and video conferencing should be considered, especially in early pregnancy where counselling forms a large component of the antenatal visit.

  During periods of lockdown and quarantine, these methods can be adopted as an alternative for routine clinic visits. Be aware that women may not disclose sensitive information in situations such as domestic abuse, sexually transmitted infections and stigmatized pregnancies. Therefore, it is important to arrange a face to face consultation at earliest possible.
- Specific precautions regarding COVID-19 for pregnant women remain the same as for the general population. Health care providers should ensure appropriate protection during antenatal clinic visits and practice hand washing regularly.
- Blood pressure assessment, symphysial fundal height measurements, urine tests for proteinuria should be conducted as routine. Screening for gestational diabetes mellitus should not be altered due to Covid 19 as it may lead to a reduction in detection rates.
- Be alert to the increased risk of antenatal anxiety and depression and domestic violence due to the financial and social impacts of the COVID-19 pandemic adding to the normal stresses of pregnancy.
- Consider the use of on-line resources or video conferencing to deliver antenatal and lactation classes. You may create an online group through social media platforms for mothers who need antenatal care.

- If women complain of symptoms of Covid -19 or has a contact history they should be advised to inform their public health midwife, Medical Officer of Health immediately. Rapid antigen test (RAT) and RT-PCR should be performed.

- Rapid antigen test false positive rate will increase when the prevalence of infection is low in the community. Therefore, consider community prevalence, contact history and presence of symptoms when formulating management for a RAT positive patient. If required obtain input from microbiologist. Until RT-PCR results are available pregnant women should be cared for in an isolation ward.

- Once RT- PCR is positive inform Obstetric consultant in care of the woman, public health inspector and medical officer of health of relevant area to arrange ongoing care and contact tracing.

- Note the RT PCR CT value (cycle threshold) indicates the concentration at which PCR becomes positive. If RT PCR value >30 indicates low positivity. Send Covid IgG antibodies and if positive can be discharged immediately.

- Covid positive pregnant women who require transfer to a different institution or a designated treatment center for specialized management, neonatal care etc. should always be discussed and informed to the obstetric consultant at the receiving institution to ensure bed availability and minimize unnecessary exposure of health staff.

- According to Ministry of Health circular (DGHS/COVID-19/347-2021) every hospital should have an isolation ward for suspected patients while awaiting investigations and an intermediate ward for confirmed Covid-19 patient awaiting transfer to a designated treatment center.

- Women attending antenatal clinic following recovery from Covid -19 infection should be offered an ultrasound scan in minimum two weeks once infection settled to assess fetal growth.

2. Management of confirmed Covid-19 infection in pregnancy

Pregnant women presenting with COVID-19 infection have the same clinical features, pathology and imaging findings as non-pregnant patients.

Majority of Covid -19 infection in pregnancy will be asymptomatic or have mild to moderate symptoms. However, some women may develop severe disease with pneumonia and respiratory failure requiring intensive care and ventilatory support. More symptomatic women and severe respiratory morbidity has been evident in the third wave of Covid -19 in Sri Lanka. Pregnant women with Covid -19 are more likely to develop mental health problems such as anxiety and depression.

The risk of fetal complications is not yet definitely known but there is no current evidence of teratogenicity, still birth or fetal growth restriction. There is insufficient evidence to comment on miscarriage. Symptomatic Covid-19 infection amongst pregnant women is associated with increased risk of preterm birth (mainly iatrogenic) and fetal distress. Vertical transmission of Covid -19 infection is uncommon.

- Risk of increased maternal morbidity is seen amongst women with:
    - Advanced maternal age > 35 years
    - Obesity
    - Medical co morbidities (Preexisting diabetes, Chronic hypertension, asthma, cardiac disease)
- Consider differential diagnosis for fever, shortness of breath and chest pain which may present along with Covid -19. Other infections such as Dengue, bacterial pneumonia, chorioamnionitis, pyelonephritis may present with similar clinical picture.
- Once RT -PCR is available use CT value (cycle threshold) as an indication of strength of positivity.

CT Value	Interpretation	Action
>30	Low positive	Send Covid-19 IgG antibodies
<30	High positive	No need to send Covid -19 antibodies

- If RT PCR value >30 it indicates low positivity. Send Covid IgG antibodies and if positive can be discharged immediately. If CT value is <30 indicates high positive patient should be isolated for 10 days.

- Covid-19 positive women who are asymptomatic may be discharged after 10 days with further 4 days home isolation. If they are near delivery or do not have facilities for home isolation they may be kept in hospital until 14 days complete. If asymptomatic women are managed at home clear thresholds for admission should be provided with emergency contact numbers.

- Covid-19 positive women who are symptomatic at day 10 may need to be kept in hospital till day 14 and even further, if the clinical situation dictates to do so. Symptoms may worsen after the period of viremia with the onset of cytokine storm. Clinically they may reveal signs of cardiovascular and respiratory insufficiency. Therefore, be cautious when assessing suitability for discharge of symptomatic Covid -19 positive women who have risk factors.

- Monitor pulse rate, blood pressure, respiratory rate, oxygen saturation and temperature during hospital stay.

- As initial investigations send Full blood count, C reactive protein. There may be lymphopenia and leucopenia and elevation of C reactive protein. Thrombocytopenia may occur with Covid-19 infection. However thrombocytosis is more common with pneumonia. Low Haemoglobin may aggravate sensation of breathlessness.

- Routine chest X ray, HRCT chest and CTPA should not be performed on all Covid-19 patients. In selected patients with moderate to severe disease, if required it may be performed after MDT. If undergoing radiological investigations ensure abdominal shield is used to minimize fetal radiation exposure.

- Antibiotics should not be routinely used for Covid-19 infection. Antibiotics may be started if suspecting secondary bacterial infection.

- Do not routinely offer Azithromycin, Hydroxycholoroquine, steroids for all patients with Covid-19.

- CTG should be performed as per obstetric indications.

- Educate mothers on continuing to practice wearing masks, hand hygiene and physical distancing in ward to minimize cross contamination with different strains.

- On discharge mothers should be advised on warning signs such as shortness of breath, breathlessness, fever and advised to contact public health midwife, MOH if feeling unwell during home isolation period.

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3. Intrapartum care for Covid-19 positive pregnant women

- Pregnant women with a known Covid-19 infection, in labour should be nursed in an isolated room, with staff wearing full PPE.
- The timing of delivery and mode of delivery will usually be determined based on the obstetric indications. It would be preferable to defer induction of labour or elective caesarean section, until a woman has completed her isolation period or until viral shedding becomes minimal. Assess the risks of postponing birth till completion of isolation period versus the urgency required for delivery. Anecdotal evidence suggests passive immunity for the neonate from maternal IgG antibodies which may be beneficial.
- Induction of labour should be offered for obstetric indications. Avoid unnecessary interventions and inductions.

- Multi-disciplinary team including Consultant Obstetrician, anesthetist, neonatologist and obstetric theatre staff must be informed if a Covid -19 positive mother is in labour / Caesarean section. Send a grouping DT for women in labour.

- Continuous electronic fetal monitoring is recommended during labour for Covid-19 positive pregnant mothers with symptoms.

- Partogram should be maintained as routine and maternal monitoring should include pulse rate, blood pressure, respiratory rate, oxygen saturation, temperature.

- Analgesia can be offered as routine during labour. Entonox can be used with a standard single patient microbiological filter. Epidural analgesia can be offered and this may avoid the need for general anesthesia. The greatest risk to staff may occur at intubation during which time the virus load from aerosolization is highest.

- Take measures to minimize obstetric emergencies as much as possible. These may include antenatal optimization of haemoglobin to prevent postpartum haemorrhage, judicial use of oxytocin to minimize fetal distress etc.

- Decision making in labour should take into consideration the possible delays which may occur during transfer to theatre, wearing PPE .

- Number of staff in labour room should be kept to minimum required in order to minimize health care worker exposure and staff exhaustion.

- Women who fail to progress in labour, develop fetal distress need to be assessed promptly and decision making done at a senior level.

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Obstetric surgical interventions in Covid-19 positive pregnant mothers

- All health care workers should wear appropriate PPE during surgical procedures of Covid-19 patients. Obstetric surgical interventions wearing personnel protective equipment (PPE) can be challenging. Main difficulties encountered include visual barriers due to misting of goggles/visors, limitation of fine movement due to multiple layers of coverings and staff exhaustion. Use recommended highest level PPE's. Always use N95 Masks- FFP 2 or 3.

- Avoid any surgical interventions as much as possible until viral load come to Zero or near Zero. i.e at least 10 days after initial diagnosis.

- Take precautions to avoid obstetric emergencies. For example, Obstetrician may have a low threshold for considering ERCS instead of going for VBAC in a Covid positive pregnancy.

- Take decisions early because delays are the rule with Covid-19 positive surgical interventions. (Blood cross matching will take 2hrs, Bringing the patient to theatre may take around 1-2hrs.)

- Plan the surgical event in advance by the senior clinical team. Surgical procedures should be conducted by experienced and skilled surgeons. Do not hand over duties to junior level.

- Take necessary precautions to avoid fogging of goggles. These may include ensuring tight seal of mask, using anti fog agents, demisters or wiping with disinfectant. Ensure clear vision before commencing surgery. If misting occurs have an alternative plan.

- All required team members should be inside labour room/ theatre at the time of delivery with full PPE. If general anesthesia is required other staff (neonatology) may wait outside after donning PPE and enter after intubation to minimize exposure.

- Keep a backup plan always. For example, fainting attacks; probably due to hypoxia and hyperthermia among operating team is reported. If any member of the team feels uncomfortable wearing PPE, replace the team member early.

4. Postpartum care of Covid -19 positive women

- There is currently no evidence that a woman with a known Covid-19 infection who has recently given birth should be separated from her baby. (Neonatal infection rate 5.6 per 10 000 live births 95% CI 4.3-7.1) (10)
- She should avoid contact with other mothers and infants. Appropriate precautions such as hand washing before contact with baby, breast pumps, wearing a face mask during

feeding and contact with the baby should be adopted. Avoid coughing, sneezing over the baby. Babies should not wear face masks as there is risk of suffocation.

- Covid -19 infection in mother is not a contraindication for breastfeeding. Benefits of breastfeeding outweigh any potential risks of viral transmission through breastmilk. A systematic review showed no evidence of Covid 19 in breast milk. Therefore, mothers should be encouraged to breastfeed. If the mother is not well enough to breastfeed expressed breast milk can be given.
- The few neonatal infections that have been reported were acquired postnatally and the late third trimester, and the infants were not significantly unwell. Fetal distress and early neonatal complications when present were considered due to maternal illness or prematurity.
- Be aware of postnatal mental health problems which may be aggravated by Covid-19 infection due to social isolation and lack of family support. Have a low threshold for arranging psychiatry referral, if mental health problems are suspected.
- Women discharged home should self-isolate till 14 days from onset of infection. Appropriate advice should be given on whom to contact in event of emergency during isolation period. Postnatal mothers should have access to health care if they have any concerns related to themselves or baby. Postnatal mothers should be advised to contact public health midwife or hospital to gain advice over the telephone in such situations.
- Home visits by public health midwife should be arranged after the self-isolation period and when appropriate can be conducted using telephone, video consultations.

5. Management of a critically ill patient with Covid -19 in pregnancy

Timely detection of a critically ill Covid-19 patient is important. Dropping oxygen saturation is an alarming sign which may indicate a rapid deterioration of the patient. This may be due to intrapulmonary shunting over Covid-19 lesions in the lung. Patients may experience minimal dyspnea compared to the level of hypoxia due to the presence of normal compliant lung tissue adjacent to affected areas. (Happy hypoxia)

- Patients with spO2 <94% on room air, respiratory rate >20, pulse rate >110bom, hypotension need urgent attention and care.

- Monitor parameters using MEOWS chart, input output chart to assess urine output.

- In addition to basic investigations perform arterial blood gas, serum ferritin, LDH, procalcitonin and fetal wellbeing assessment.

- CXR should be arranged to exclude other pathology and typical changes of Covid-19 infection. If required CTPA can be performed to exclude pulmonary embolism. A 2D echocardiogram may be arranged if indicated.

- An urgent multidisciplinary team meeting involving Consultant Obstetrician, Consultant Anesthetist, Consultant Neonatologist, Consultant Respiratory Physician and Microbiologist should be held. Key points requiring discussion should include

    - Determining place of continuing care (High dependency Unit, Intensive care)
    - Key elements in medical treatment (Use of biologics and antivirals)
    - Thresholds for interventions (intubation and delivery)
    - Any other concerns regarding pregnancy and the infection

- Decisions made at the multi-disciplinary meeting should be clearly documented and attached to patient notes.

- Oxygen should be administered to target a spO2 of >94%.

  If SpO2<94% with no evidence of dyspnea or increased inspiratory effort : oxygen can be delivered through low flow oxygen devices such as oxygen face mask, venturi mask, or non re breathing mask.

  If SpO2 <94% with evidence of deterioration or SpO2 <90%: High flow nasal Oxygen therapy (HFNO) (commencing at 15-30L/min increasing to 40-60L/min gradually) or non invasive ventilation in the form of CPAP (commencing at 8L/min to a maximum of 25L/min). Consider using HFNO intermittently according to patient requirement. Consider hospital capacity to supply oxygen and usage of HFNO simultaneously in the hospital (may require 12 jumbo cylinders per day)

  If there is progressive deterioration indicated by desaturation despite oxygenation, respiratory rate >30/min, P/F ratio <300, S/F (saturation / Fraction of O2) ratio <235, haemodynamic instability patient will require intubation and invasive ventilation.

- Prone positioning for 16hrs can be done to improve ventilation and reduce oxygen requirement. Should be considered in second and early third trimester. Pressure point care must be arranged on regular basis(11).
- Corticosteroids should be administered for 10 days. If steroids are required for lung maturity intramuscular Dexamethasone 6mg 12 hourly 4 doses should be given followed by oral prednisolone 40mg daily or IV hydrocortisone 80mg bd for a total of 10 days. If steroids are not required for lung maturity IV hydrocortisone 80mg bd or Prednisolone 40mg daily can be given for 10 days or up to discharge whichever is sooner. (Hydrocortisone and prednisolone are extensively metabolized in the placenta with minimal transfer to fetus as repeated doses of steroids may have harmful neonatal effects). Use of steroids in RECOVERY trial reduced 28 day mortality in individuals with Covid-19 requiring oxygen therapy (age-adjusted rate ratio 0.83, 95% CI 0.75–0.93; $P < 0.001$)(12).

- Tocilizumab (Interleukin -6 receptor antagonist) 4-8mg/kg bodyweight can be administered and repeated in 12 hours if indicated. Considered beneficial for patients with hypoxia with systemic inflammation (CRP >75mg/L). Must exclude underlying secondary infection prior to commencing and therefore procalcitonin levels should be traced. Decision on starting Tocilizumab should be made at the MDT meeting and informed written consent should be obtained from the patient and partner as there are limited data on its use in pregnancy. Available limited evidence of drug registries does not show any harm at present. Tocilizumab improved survival and clinical outcome in patients with hypoxia and systemic inflammation, ICU admission and in patients requiring organ support reduced progression to intubation, ECMO or death(13).
- Remdesivir should be avoided unless benefits outweigh the risks and decision to treat should be made at MDT. Fetal risk profile is largely unknown. WHO Solidarity trial showed no effect on overall mortality, initiation of ventilation and duration of hospital stay with Remdesivir(14).
- Gamma immunoglobulin have been used in patients who do not respond to initial treatment(15). The evidence is limited but maybe considered in special situations. Consider gamma globulin in MDT meeting.
- Thromboprophylaxis measures should be adopted to minimize thrombosis. This includes administration of Low molecular weight Heparin (dose determined by pre-pregnancy weight), TED stockings. Therapeutic doses of LMWH should only be commenced if clinical suspicion of Venous thromboembolism present. Take into consideration timing of delivery and need to withhold anticoagulation prior to surgery.
- Thrombocytopenia may occur with Covid-19. If platelet count $<50x\ 10^9$ LMWH and Aspirin should be discontinued. Mechanical thromboprophylaxis should be given.
- IV antibiotics may be started if suspecting secondary bacterial infection and sepsis. Secondary bacterial infection may be present with Covid-19 and clinicians should be alert to this possibility.

- Myocardial injury is reported with severe Covid-19 infection. Consider ECG, 2D echocardiography and Troponin titers if suspected.

- If patient is not improving multidisciplinary meetings may need to be repeated and decisions reviewed.

- Consider delivery if aid is required to improve mechanical ventilation. If intubation is required and patient is in the third trimester intubation can be performed in the theatre with immediate delivery.

- Consider the possibility of requiring ECMO when formulating the management plan. ECMO is possible during pregnancy. Women who do not improve with mechanical ventilation may require ECMO to maintain oxygenation until lungs recover. However, ECMO has limited availability and has its own complications. Liaise with ECMO centers early.

- Continuous liaison with the patient and family members is important ensuring effective communication.

6. Vaccination in pregnancy and breastfeeding

The global pandemic with its health and economic impact led to the rapid development of Covid-19 vaccines which have proven efficacy in preventing infection and minimizing the severity of disease. Although several vaccines are available, pregnant and lactating women were excluded in clinical trials. Therefore, there is limited evidence on the use of Covid-19 vaccines in pregnancy.

However, due to the rapid spread of SARS-Cov-2 and its associated maternal and neonatal effects, emergency authorization for the use of Covid -19 vaccines in pregnant women was granted in several countries. In USA 90,000 pregnant women have been successfully vaccinated using mRNA vaccines with no reported safety concerns. In United Kingdom vaccination is offered for high risk pregnancies. Existing limited evidence of the use of Covid -19 vaccines in pregnancy stems from these countries and from individuals who inadvertently became pregnant following vaccination(16). Unpublished reproductive toxicology studies in animals using Moderna vaccine revealed no safety concerns related to pregnancy and fertility.

At present use of BIBP vaccine has be authorized by WHO for use in pregnancy. Considering the current pandemic, its impact on maternal and fetal morbidity and mortality Panel of experts from Sri Lanka College of Obstetricians and Gynaecologists (SLCOG) recommends the offering of covid-19 vaccines to pregnant women irrespective of gestation as an informed choice. SLCOG recommends all pregnant women in Sri Lanka should be offered covid – 19 vaccine after providing information about the risks of covid 19 in pregnancy and risks and benefits of the vaccination to each woman individually. SLCOG strongly recommends supervising, monitoring and reviewing of the vaccination program.

Risk benefit discussion should include the following(16)(17)(18) :

<table>
<tr><th>Benefits</th><th>Risks</th></tr>
<tr><td rowspan="4">Pregnant women are vulnerable for severe Covid-19 compared to non pregnant women particularly in the 2nd and 3rd trimester. Risk increases with co morbidities such as increased maternal age, high BMI, co morbidities such as Diabetes, Hypertension, heart disease etc. Women with these conditions should have a lower threshold to obtain vaccination during pregnancy.

Severe infection can lead to preterm birth which may have long term impact on baby.

Covid-19 vaccines have proven efficacy in preventing infection and reducing severity of disease. Therefore, through vaccination these complications can be potentially avoided.</td><td>No studies have been specifically done in pregnant and lactating women with regard to covid-19 vaccines. Therefore level of evidence is small and limited.</td></tr>
<tr><td>Side effects of vaccines are common.

These are not known to effect pregnancy and are part of the normal immune reaction to the vaccine. These include :

- Injection site reactions
- Fever
- Chills
- Headache
- Muscle and joint pains
- Fatigue</td></tr>
<tr><td rowspan="2">Covid vaccine contents (m-RNA and vector vaccines) are not known to contain any additional components which are known to be harmful in pregnancy and has no potential to cause Covid-19.

Existing evidence in use of vaccination in pregnant women has not shown any safety concerns. Animal studies have not shown any association with miscarriage or any fertility concerns.</td><td>Serious side effects are extremely rare. These have not been reported in pregnant women but in general population. These include

- Thrombosis with Aztrazenica vaccine (4 in 1 million doses)

- Thrombosis and thrombocytopenia syndrome (TTS) with Janssen vaccine (7 in 1 million doses) in women of reproductive age. Typically occur 6-14 days after vaccination.</td></tr>
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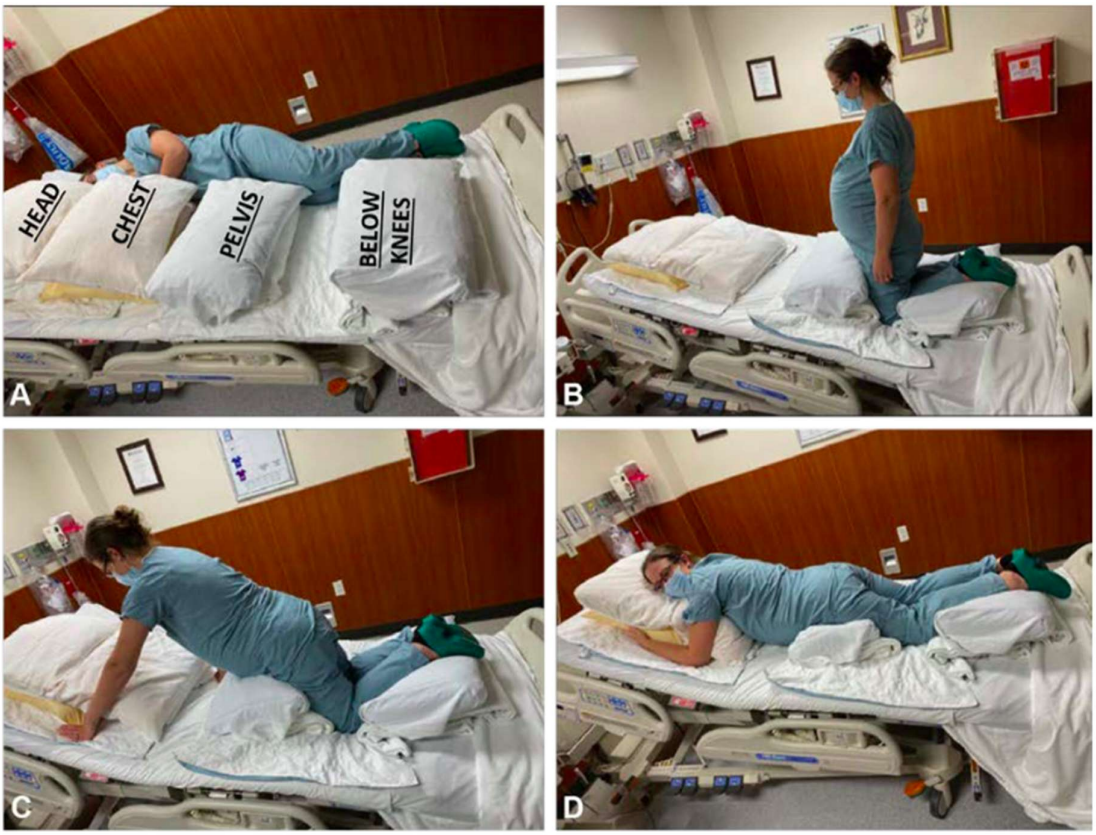
Vaccinated pregnant women should be monitored for short term and long term adverse outcomes through a registry. Pfizer and Moderna vaccines are preferable to be given if they become available as most data on pregnancy is available for these two vaccines.

Annexures

Annexure 1: Maternity management plan for Covid-19 in pregnancy

Disease severity	Suggested actions	Considerations for viable fetus
SpO_2 >94% on room air Respiratory rate < 20	Ensure no obstetric/medical concerns Discharge if asymptomatic on day 10 with further 4 days home isolation. If symptomatic at day 10 keep till day 14 or clinically indicated.	Arrange growth scan in 2 weeks to assess fetal growth. Induction and delivery dictated by obstetric indications.
SpO_2 >94% requiring oxygen with FiO_2 <35% Respiratory rate > 20	Oxygen via face mask, venturi mask or non rebreathing mask. Can increase flow to 15L/min. Arrange MDT HDU care / steroids / Tocilizumab	Assess fetal well being by fetal monitoring Based on gestation Decide on timing and mode of delivery based on gestation. Consider steroids for lung maturation Consider Magnesium Sulphate for neuroprotection
SpO_2 >94% requiring oxygen with FiO_2 >35% Respiratory rate >20 Clinical deterioration	High flow nasal oxygen (HFNO) starting at flow rate 15L/min and increasing to 40-60L/min or NIV with CPAP commencing at 15-30L/min to max 25L/min Arrange urgent MDT HDU / ICU care Consider awake prone positioning Steroids / Tocilizumab/ thromboprophylaxis	
SpO_2 <94% requiring oxygen with FiO_2 >35% Respiratory rate >30 Clinical deterioration P/F <300 or S/F <235 Haemodynamic instability	May need intubation and ventilation Urgent MDT Transfer to ICU Steroids / Tocilizumab / IVIG/ thromboprophylaxis / antibiotics / Prone positioning Arrangements for ECMO initiation	

Annexure 2: Awake prone positioning of pregnant women



A: Patient lies on side facing oxygen source. Detach monitors. Bed adjusted to reverse Trendelenburg (10^0). Place 3 pillows at heat, 2 above gravid uterus, 2 at level of pelvis (pubic symphysis level) and 2 below knees.

B: Help patient kneel between the two-lower set of pillows. Ensure pelvic pillows are touching thighs. Raise head end of the bed.

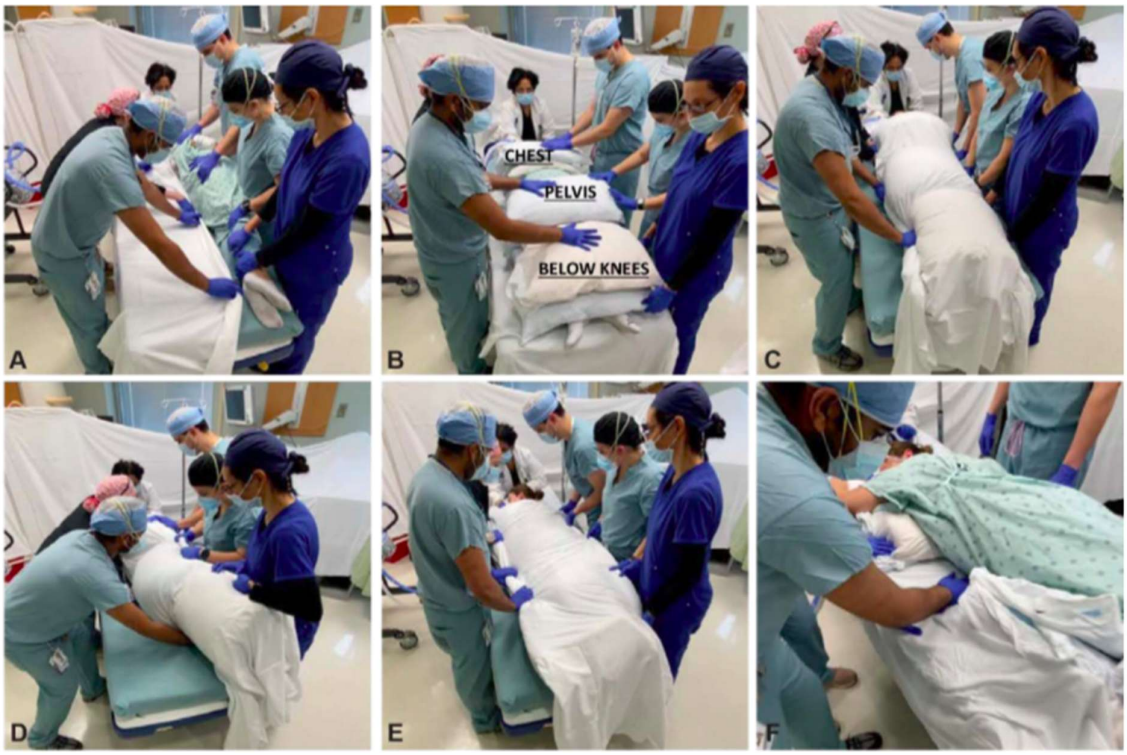
C: Help patient lie forward on the pillows.

D: Lower head end of the bed to reverse Trendelenburg. Check abdomen and ensure no pressure. Position arms overhead or to the side / swimmer's position. Replace any maternal or fetal monitors.

Contraindications

- Haemodynamic instability or life-threatening arrhythmias
- Spinal instability
- Increased intracranial pressure
- Fetal distress requiring immediate delivery
- Acute respiratory decompensation requiring intubation or uncooperative (for awake prone positioning)
- Post Caesarean, tracheal or chest surgery within 48hrs (relative)
- >34 weeks (relative)
- Cardiac pace makers / chest tubes / facial injury (relative)

Annexure 3: Prone positioning of intubated patient



A: Anesthetist at head end stabilizing endotracheal tube, head and neck will lead and count all maneuvers. Roll patient to side and spread clean sheet on the bed.

B: Tuck arm closest to ventilator underneath buttocks with palm facing up and position patient back into supine on the clean sheet. Place 2 pillows above gravid uterus, 2 at level of pelvis and 2 under knees. Keep another 2 in reach to pad head.

C: Spread another clean sheet over the pillows and roll both sheets above and below the patient to encase the patient and pillows. Slide patient horizontally to the edge of bed away from the ventilator.

D. Roll patient 90^0 to a side facing the ventilator. Staff need to change position of hands and readjust grip on the sheets.

E: Roll patient to prone position.

F: Check abdomen to ensure no pressure on uterus. Arms kept in Swimmer's position. (need to change head and arm position every 2 hours). Bed positioned in reverse Trendelenburg position(10^0). Replace maternal and fetal monitors.

Annexure 4: Arterial blood gas interpretation in pregnancy and oxygen delivery devices

Parameter	Value
pH	7.40-7.47 (Increased)
$PaCO_2$	30mmHg (Decreased)
PaO_2	105mmHg (Increased)
HCO_3^-	20mmol/L (Decreased)

Pregnancy related physiological changes lead to an increase in tidal volume with unchanged respiratory rate. This leads to increased alveolar ventilation. As a result of the CO_2 washout it results in a physiological compensated respiratory alkalosis.

Device	Oxygen flow rate	FiO_2
Nasal cannula	1- 6 L/min	Each L/min adds 4% above room air. 2L/min – 24% 3L/min - 28% 4L/min – 32% 5L/min – 36% 6L/min – 40%
Simple face mask	6-12 L/min	35-60%
Venturi mask	Fixed flow depending on adaptor used	Adaptors available for 24%, 28%, 31%, 35%, 40%
Non rebreathing mask	10-15L/min	100%
High flow nasal cannula	60L/min	30-100% provides PEEP with a high flow rate

References

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